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leaf, in December. Owing to the fact that it is always found associated with *Glucosporium nervisequum* and in its immediate vicinity, it is suspected that the two are stages in the development of the same fungus, the more so because the spores are so very similar. It is conceivable that the mycelium passes from the petioles into the branches and there produces the pycnidia of *Discula* whose spores develop into *Glucosporium* upon the leaves.\* But such a connection could not be established either by natural or artificial methods, and the question still remains an open one.

(To be continued.)

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## NORTH AMERICAN AGARICS.

(Genus *Russula* (*russulus*, reddish). Fr. Hym. Eur., p. 439.)

By ROBERT K. MACADAM.

### PART I.

Pileus fleshy, convex then expanded, and at length depressed; stem stout, polished, *not corticate*, generally *spongy* within, confluent with the hymenophore; gills *nearly equal*, *milkless*, *rigid*, *brittle*, with an acute edge, sometimes dropping *water*; trama vesiculose; veil entirely *obsolete*; spores white or very pale yellow, generally echinulate.

*Habitat*.—On the ground, generally in woods or the vicinity of trees in summer and autumn.

This genus is interesting on account of the beauty and brilliant coloring of many of its species, and especially so to amateurs, as it is one of the few divisions of *Agaricini* which can be readily distinguished. Members of it may be recognized by the stout spongy stem, dry texture, and extreme brittleness; they are generally found in grassy woods and are of nearly all colors, frequently with the cap a brilliant red, pure white, or white blotched or shaded with red. *Russula* is allied to *Lactarius*, but is distinctly separated by the absence of *milk* in the gills; those of some *Russula* distill drops of water, especially in rainy weather. The internal structure is also related, as shown by the presence, in the acrid species, of the milk-secreting vessels of *Lactarius*, but in an undeveloped form.

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\* At the bases of the infected shoots this spring there was almost invariably a dead area on the lignified branch, and mycelium was invariably present in the tissues; this mycelium penetrated into the vessels of the wood and could not be morphologically distinguished from that in leaves infested with *G. nervisequum*. Many buds had died either in late autumn or during winter and there were similar but larger dead areas around them, and in these *Discula platani* often made its appearance. Indeed, it is almost impossible to avoid the conclusion that the mycelium of *Glucosporium nervisequum* extends into the woody parts of the branches, where the fruit of the fungus assumes a different form. The formation of the mass of pseudo-parenchyma may possibly be explained on the ground that it is necessary in order to rupture the epidermis and cork layer of the bark; and when this is accomplished it disappears.—E. A. S.

The genus contains some of the best edible mushrooms and others which are extremely poisonous, and, on account of the extreme variability of color, they often resemble each other so closely that the amateur must depend entirely upon taste in selecting the esculent ones.

Taste a piece of the stem of *each* plant as gathered and reject all not having a mild and pleasing flavor, as all the known noxious species are acrid or unpleasant. Be sure that your plant is a *Russula*, as this rule is *not* universal and *must not* be applied to mushrooms in general. The application of this method will enable the novice to enjoy some of the best viands in this class.

"I. COMPACTÆ (*compingo*, to put together; compact). Pileus fleshy throughout, hence the margin is at first bent inwards and always without striæ, without a distinct viscous pellicle (in consequence of which the color is not variable, but only changes with age and the state of the atmosphere). Flesh compact, firm. Stem solid, fleshy. Gills unequal.

"II. FURCATÆ (*furca*, a fork. With *forked* gills). Pileus compact, firm, covered with a thin, closely adnate pellicle, which at length disappears, margin abruptly thin, at first inflexed, then spreading, acute, even. Stem at first compact, at length spongy-soft within. Gills *somewhat forked*, with a few shorter ones intermixed, commonly attenuated at both ends, thin and normally narrow.

"III. RIGIDÆ (*rigidus*, rigid). Pileus without a viscid pellicle, *absolutely dry, rigid, the cuticle commonly breaking up into flocci or granules*. Flesh thick, compact, firm, vanishing away short of the margin, which is straight (never involute), soon spreading, and always *without striæ*. Stem solid, at first hard, then softer and spongy. Gills, a few dimidiate, others divided, rigid, *dilated in front and running out with a very broad rounded apex*, whence the margin of the pileus becomes obtuse and is not inflexed. *Exceedingly handsome* but rather rare.

"IV. HETEROPHYLLÆ (*R. heterophylla*, the typical species of the section). Pileus fleshy, firm, with a thin margin, which is at first inflexed, then expanded and striate, covered with a thin, adnate pellicle. The gills consist of many shorter ones mixed with longer ones along with others which are forked. Stem solid, stout, spongy within.

"V. FRAGILES (*fragilis*, fragile or brittle). Pileus more or less fleshy, rigid-fragile, covered with a pellicle which is always continuous and in wet weather viscid and somewhat separable; margin membranaceous, at first convergent and not involute, in full-grown plants commonly sulcate and tubercular. Flesh commonly floccose, lax friable. Stem spongy, at length wholly soft and hollow. Gills almost all equal, simple, broadening in front, free in the pileus when closed. Several doubtful forms occur. *R. integra* is specially fallacious from the variety of its colors.

"\* Gills and spores white.

"\* \* Gills and spores white, then light-yellowish or bright lemon-yellow.

"\* \* \* Gills and spores ochraceous."—STEVENSON.

## I. COMPACTÆ.

1. "*R. NIGRICANS*, (Bull.) Fr., Hym. Eur., p. 439; Cke. 111, 1015; Stev., B. F., p. 114; Sacc., Syll., p. 453. Pileus 2-4 inches (5-10 centimeters) and more broad, olivaceous-fuliginous, *at length black*, fleshy to the margin which is at first bent inwards, convex, then flattened, umbilicato-depressed, when young and moist slightly viscid and even (without a separable pellicle), at length rimose-squamulose; flesh firm, white, when broken becoming red on exposure to the air. Stem 1 inch (2.5 centimeters) thick, persistently solid, equal, pallid when young, *at length black*. Gills *rounded* behind, slightly annexed, *thick, distant*, unequal, paler, reddening when touched.

"Compact, obese, inodorous within and without, *at length wholly black*, in which it differs from all others. The flesh becomes red when broken because it is saturated with red juice, although it does not exude milk. Sometimes a very few of the gills are dimidiate. In woods. Common. June-November. Spores papillose,  $8\mu$ . W. G. S. Coarse in habit. Name—*nigrico*, to be blackish. (Fr., Monogr., ii, p. 184; Berk. Out., p. 209; C. Hbk., n. 613; S. Mycol. Scot., n. 532; Hussey, i, t. 73; Ag. Bull., t. 579. f. 2, t. 212; Krombh., t. 70, f. 14, 15; Barla, t. 17; Sow., t. 36.)"—Stevenson.

Taste disagreeable. Massachusetts,\* Frost; Minnesota, common, July and August, Johnson; New York, our specimens agree with the description in every respect, except that the gills are not distant, August and September, Peck, thirty-second report; New Jersey, Ellis.

2. "*R. ADUSTA*, (Pers.) Fr., Hym. Eur., p. 439; Stev., B. F., p. 114; Sacc., Syll., p. 454. Pileus pallid or whitish, *cinereous-fuliginous*, equally fleshy, compact, depressed then somewhat infundibuliform, margin at first inflexed, smooth, then erect, without striæ; flesh unchangeable. Stem solid, obese, of the same color as the pileus. Gills adnate, then decurrent, *thin, crowded*, unequal, white, then dingy, not reddening when touched.

"It can only be compared with *R. nigricans*, but is sufficiently distinct; stature commonly smaller, flesh juiceless, not reddening, etc. The pileus does not become black, but only of a scorched appearance. In woods. Frequent. August to October. 'Well distinguished by its thin, crowded gills,' etc. M. J. B. 'Spores sphaeroid, echinulate,  $7-9\mu$ , globose, rough,  $8$ .' C. B. P. Name—*aduro*, to scorch, from its scorched appearance. (Fr., Monogr., ii, p. 184; Berk. Out., p. 209; C. Hbk., n. 614; S. Mycol. Scot., n. 583; Ag., Pers. Krombh., t. 70, f. 7-11; Batt., t. 13.)"—Stevenson.

North Carolina and Pennsylvania, Schweinitz; North Carolina, woods and thickets, Curtis; Massachusetts, Frost; Minnesota, September and October, Johnson; California, Harkness and Moore; Nova Scotia, pine woods, September, Somers, R. J. Bennett.

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\* These references are placed with regard to the order of their dates.

3. "R. DELICA, Fr., Hym. Eur., p. 440; Stev., R. F., p. 115; Sacc. Syll., p. 455. Pileus white, 3-5 inches (7.5-12 centimeters) broad, fleshy throughout, firm, umbilicate then infundibuliform, regular, everywhere even, smooth with a *whitish* luster, the involute margin without striæ; flesh firm, juiceless, not very thick, white. Stem curt, 1-2 inches (2.5-5 centimeters) long,  $\frac{1}{2}$  inch (12<sup>mm</sup>) and more thick, solid, even, smooth, white. Gills *decurrent, thin, distant*, very unequal, white, exuding small watery drops in wet weather.

"The stature and *unchangeable colors* are wholly those of *L. vellereus* and *L. piperatus*, but it is readily distinguished *by the gills being juiceless*, though they exude watery drops when young. In mixed woods. Uncommon. September-October. Name—*delicus*, weaned; without juice or milk in the gills, as distinguished from *L. vellereus*, etc. (Fr., Monogr., ii, p. 185; Berk. Out., p. 210; C. Hbk., n. 615; S. Mycol. Scot., n. 585; Vent., t. 48 f. 3, 4; Batt., t. 17 A; Paul., t. 73 f. I,") Stevenson.

"Edible. Taste mild. Spores 8-10 by 6-8 $\mu$ . Sacc., Syll. From the juiceless variety of *Lact. vellereus* its mild taste alone furnishes a separating character."—Peck.

A large, coarse species, cup-shaped at maturity. I have found it in several localities in Massachusetts in July and August. It is of fair quality, cooked, but much inferior to *R. virescens*, etc. Minnesota, in woods, August, Johnson; New York, Peck, 32d Report; California, Harkness & Moore.

4. "R. SORDIDA, Peck, 26th Rep. N. Y. State Mus. Nat. Hist., 1874, p. 65; Sacc., Syll., p. 459. Pileus 3-5 inches (7.5 centimeters) broad, firm, convex, centrally depressed, dry, sordid white, sometimes clouded with brown; gills close, white, some of them forked. Stem 4-5 inches (10-12.5 centimeters) long,  $\frac{1}{2}$ -1 inch (12-24<sup>mm</sup>) thick, equal, solid, concolorous; spores globose, .0003 inch (7.5 $\mu$ ); taste acrid, flesh changing color when wounded, becoming black or bluish-black.

"Ground under hemlock trees, Worcester, July.

"It resembles *L. piperatus* in general appearance. The whole plant turns black in drying.

"A large form of this species was found growing under hemlock trees at Gansevoort. The pileus was 4-8 inches (10-20 centimeters) broad, at first white or whitish, umbilicate or centrally depressed; then more or less stained with smoky-brown or blackish hues and subinfundibuliform. The flesh is white and taste mild; the stem is short, 1-2 inches (2.5-5 centimeters) thick, solid, white, and somewhat pruinose; the gills are distant, unequal, very brittle, tinged with yellow. Every part of the plant turns blackish or violaceous black where wounded. By this character it is distinguished from *R. nigricans*, in which the flesh at first becomes red where broken." 41st Rep. Peck. Found also in Ohio by Professor Morgan, under beech trees in hilly woods.

5. "R. COMPACTA, Peck, 32d Rep. N. Y. State Mus. Nat. Hist., 1879, p. 32. Pileus white, firm, solid, cracked in age, sometimes tinged with

red or yellow or both in spots, turning up in age, seldom depressed; lamellae very white, almost free, not forked or dimidiate, becoming brown when bruised or dry; stem solid, white, even, smooth; flesh at first white, then brownish."—Frost.

"Pileus 3–5 inches (7.5–12.5 centimeters) broad, fleshy, compact, convex or centrally depressed, whitish, sometimes tinged with red or yellow, becoming reddish-alutaceous or dingy-ochraceous with age, the margin thin, even, incurved when young. Gills rather broad, subdistant, nearly free, some of them forked, a few dimidiate, white, becoming brown with age or where bruised. Stem 2–4 inches (5–10 centimeters) long,  $\frac{2}{3}$ –1 inch (16–24<sup>mm</sup>) thick, short, equal, firm, solid, white, changing color like the pileus; spores subglobose, nearly even, .00035 inch (9 $\mu$ ) in diameter.

"Open woods. Sandlake and Brewerton. August and September.

"The late Mr. C. C. Frost sent me specimens and manuscript descriptions of a few species of fungi collected by him in Vermont. He gave names to those which he considered new species, and it gives me pleasure to adopt his names whenever it is rendered possible by the discovery of the species within our limits. The plant here described does not fully agree with his manuscript description, which I have quoted, but it approaches so near an agreement that there can not be much doubt of the specific identity of the two plants. In our plant the pileus is sometimes split on the margin. The change in the color of the pileus and stem is nearly the same, but the lamellae sometimes becomes darker than either. When drying, the specimens emit a strong and very disagreeable odor."—Peck. Massachusetts, Frost.

## II. FURCATÆ.

6. "R. OLIVASCENS, Fr. Hym. Eur., p. 441; Sacc. Syll., p. 456. Pileus everywhere fleshy, expanded, umbilicate, *olivaceous*, the *disk becoming yellow*, margin even. Stem firm, even, pure white. Gills attenuated behind, crowded, almost equal, *white, becoming yellowish*. In frondose groves. This noble species should from its habit be placed among the *Furcata*, but the gills are more rarely forked and their form approaches that of the *Fragiles*. In several respects it agrees with the *Compactæ*."—Fr.

Spores ochraceous. 8–10 by 6–8 $\mu$ . Sacc. Syll. New York, in woods.

7. "R. FURCATA, (Pers.) Fr. Hym. Eur., p. 441; Stev., B. F., p. 116; Sacc. Syll., p. 456. Pileus about 3 inches (7.5 centimeters) broad, sometimes æruginous-greenish, sometimes umber-greenish, fleshy, compact, gibbous, then plano-depressed or infundibuliform, *even*, smooth, but often *sprinkled with slightly silky luster*, pellicle here and there separable, margin thin, at first inflexed, then spreading, always *even*; flesh firm, somewhat cheesy, white. Stem 2 inches (5 centimeters) or a little more long, solid, firm, equal or attenuated downwards, even, white. Gills *adnate-decurrent, rather thick*, somewhat distant but broad, attenuated

at both ends, frequently forked, shining white. Spores globose, echinulate,  $6-7\mu$ . C. B. P. Name, *furca*, a fork. With forked gills. (Fr. Monogr. ii. p. 187; Berk. Out. p. 210; C. Hbk. n. 616; S. Mycol. Scot. n. 586; Ag. Pers. Krombh. t. 62. f. I, 2, t. 69. f. 18-22; Bull. t. 26; Schaeff. t. 94; f. I. Barla t. 16, f. 1-9; Harz. t. 54, t. 63, f. 5; Paul. t. 74. f. 1; Buxb. C. v. t. 47, f. 2.)—Stevenson.

Taste, bitterish saline. This species has been considered poisonous, but later researches indicate that it is probably harmless. North Carolina and Pennsylvania common in grassy woods, Schweinitz; North Carolina, Curtis; Massachusetts, Frost; Minnesota, common in woods, September, Johnson; Wisconsin, Bundy; New Jersey, Ellis; Ohio, common, Morgan.

8. "R. SANGUINEA, (Bull.) Fr. Hym. Eur., p. 442; Stev., B. F., p. 116; Cooke, Ill., 1019; Sacc. Syll., p. 457. Pileus 2-3 inches (5-7.5 centimeters) broad, blood-red or becoming pale round the *even*, spreading, *acute margin*, fleshy, firm, at first convex obtuse, then depressed and infundibuliform and commonly globose in the center, polished, even, *moist* in damp weather; flesh firm, cheesy, white. Stem stout, spongy-stuffed, at first contracted at the apex, then equal slightly striate, white or reddish. Gills at first adnate, then truly decurrent, very crowded, very narrow, connected by veins, fragile, somewhat forked, shining white. Taste, *acid*, peppery. Often confounded with *R. rubra*, which is of the same color, but entirely different from it in the firm, solid flesh, in the gills being adnate, then deeply decurrent, and acuminate in front. In woods, chiefly fir. Uncommon. August, September. Poisonous. Name, *sanguis*, blood. Blood-colored." (Fr. Monogr., ii, p. 188; Berk. Out., p. 210; C. Hbk. n. 617; S. Mycol. Scot. n. 587; Ag. Bull., t. 42.)

Minnesota, in woods, July, Johnson; Wisconsin, Bundy; California, Harkness & Moore; Nova Scotia, in pine woods, September, Somers.

9. "R. ROSACEA, Fr. Hym. Eur., p. 442; Stev., B. F., p. 117; Cooke, Ill., 1020; Sacc. Syll., p. 457. Pileus 2-4 inches (5-10 centimeters) broad, somewhat flesh-colored, varying in intensity, becoming whitish when the pellicle disappears, often *variegated with darker spots when dry*, compactly fleshy, at first convex, then expanded, obtuse, commonly *unequal*, repand, evenly incised, covered with a pellicle which is *viscid* and separable in wet weather, *margin acute*, even; flesh firm, cheesy, white. Stem about 2 inches (5 centimeters) long, solid, firm, at length spongy internally, even, smooth, occasionally ventricose, white or reddish. Gills in every stage of growth adnate, thin, crowded, fragile, forked behind, with dimidiate ones intermixed, always persistently white. Spores papillose,  $7\mu$  (W. G. S.). Name, *rosa*, a rose; rose-colored. (Fr. Monogr. ii, p. 188; Berk. Out., p. 210; C. Hbk., n. 618; S. Mycol. Scot., n. 588; Ag. Bull., t. 509, f. z.)—Stevenson.

Taste *slowly acid*. Allied to *R. sanguinea*, but irregular, often eccentric, with the pileus somewhat repand, *scarcely depressed*, and the

gills less crowded, broader, less divided, *scarcely* connected. In mixed woods. Frequent. September, October.

Minnesota, July, Johnson; Rhode Island, Bennett.

10. "R. SARDONIA, Fr. Hym. Eur., p. 442; Stev., B. F., p. 117; Sacc. Syll., p. 458. Pileus 2-3 inches (5-7.5 centimeters) broad, reddish, etc., fleshy, compact, convex, then plane, rarely depressed, but here and there repand, with an adnate pellicle, which is viscid in wet weather, and soon changes color, and then often spotted, *margin even*. Stem 1½-2 inches (4-5 centimeters) long, almost 1 inch (2.5 centimeters) thick, solid, firm, but at length spongy within, even, white, or reddish. Gills adnate, *crowded*, broad, somewhat forked, *white*, exuding watery drops in wet weather, whence arise *yellowish* spots when dry. Robust, firm. The color is very changeable, sometimes reddish, sometimes pallid with yellow spots, sometimes dingy yellow, opaque. Flesh same as in *R. rosacea*, etc. Intermediate between *R. rosacea* and *R. expallens*, but distinct from both in color, becoming yellow.

"In woods, chiefly fir. Uncommon. September.

"Name—from its acrid taste—*Herba sardonica* (probably *Ranunculus sceleratus*), screwing the mouth with its bitterness. (Fr. Monogr. i. ip. 189; Berk. Out. p. 211; C. Hbk. n. 619; S. Mycol. Scot., n. 589; Ag. Krombh. t. 68, f. 1-4; Schaeff. t. 16, f. 5, 6.") Stevenson.

Spores, 8-10 by 8μ. Sacc. Syll. Minnesota, July, Johnson; Wisconsin, Bundy.

11. "R. DEPALLENS, (Pers.) Fr. Hym. Eur., p. 442; Stev., B. F., p. 117; Cooke, Ill., 1021; Sacc. Syll., p. 458. Pileus pallid reddish or inclining to fuscous, etc., fleshy, firm, convex, then plane, more rarely depressed, but commonly *irregularly shaped and undulated*, even, the thin adnate pellicle presently changing color, especially at the disk, the spreading margin even, but slightly striate when old; flesh white. Stem about 1½ inches (4 centimeters) long, solid, firm, commonly attenuated downwards, *white, becoming cinereous* when old. Gills adnexed, broad, crowded, distinct, but commonly forked at the base, often with shorter ones intermixed. Inodorous, taste mild. The color of the pileus is at first pallid reddish, or inclining to fuscous, then whitish or yellowish, opaque in every stage of growth. It approaches nearest to the *Heterophyllae*.

In beech woods, pastures, etc. Uncommon. August-September.

Name—*de*, and *palleo*, to be pale. Becoming pale. (Fr. Monogr. ii. p. 189; Berk. Out. p. 211; C. Hbk. n. 620; S. Mycol. Scot. n. 590; Krombh. t. 66, f. 12, 13.") Stevenson.

Edible. North Carolina and Pennsylvania, in pine woods, Schweinitz; North Carolina, in pine woods, Curtis; Minnesota, in thin woods, July Johnson; Wisconsin, Bundy; Nova Scotia, under spruce, Somers.

(To be continued.)



shall remain lying about in the vineyard. Likewise in hewing must all resulting wood fragments be scrupulously gathered and immediately removed. All stocks once attacked by the disease must be pulled out and burned as soon as possible—all still existing roots, with the very utmost speed. Finally, moreover, care must be taken in the removal of vine stakes at the beginning of the winter that the points, sometimes broken off in this way, are not left in the ground. Were it in general practicable, from local or pecuniary reasons, to remove the vine palings entirely and substitute cultivation upon wires, then certainly one chief source of infection would be entirely removed. In conclusion, it may also be mentioned that where persons do not feel able to do without forest litter in the cattle stables and the use of the resulting manure in the vineyard, a frequent scattering of Stassfurt fertilizer or kainit in the stables and on the dung pile will result in good, as thereby, the beginning of this fungous mycelia will be hindered."

Three other underground parasites are considered—*Phasmodiophora*, *Dermatophthora necatrix*, and *Rosellina quercina*; but no mention is made of *Agaricus melleus* or of Hartig's *Trametes radiciperda*, which Brefeld now says (VII, p. 14) should unquestionably be referred to *Polyporus annosus*, Fr.—ERWIN F. SMITH.

## DESCRIPTION OF PLATES.

### PLATE IX (after von Tavel).

#### *Glœsporium nervisequum.*

FIG. 1. Cross-section through a vein and pustule of the fungus; the basidia are only partially drawn. The abscision of spores has not yet begun. x 380.

2. Spores. x 380.

#### *Fenestella platani.*

3. Cross-section through a young stage. The representation of the host plant is diagrammatic. x 128.

4. More advanced stage. x 128.

5. Same mature. The spore mass is only indicated. x 80.

### PLATE X.

FIG. 1. *Langloisula spinosa* mycelium. E. A. Southworth, del.

2. Spores. E. A. S., del.

3. *Diorchidium Tracyi*, ure-dospores. E. A. S., del.

4. Teleulespores. E. A. S., del.

5. *Septosporium heterosporum*, tuft of conidia. After E. A. S.

6. Spores. After E. A. S.

